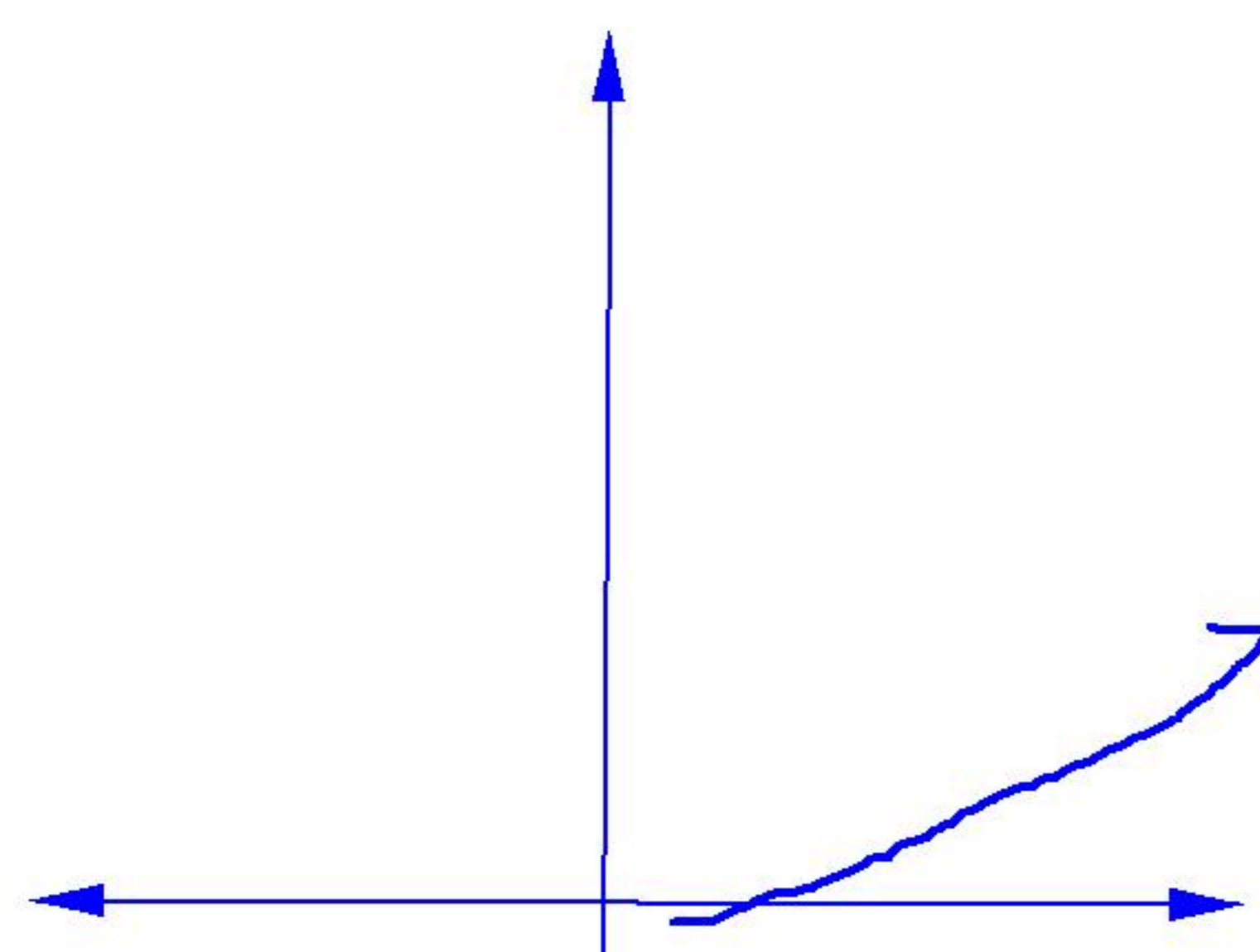


7.1 Graph Exponential Growth Functions

Goal • Graph and use exponential growth functions.

$2^2 \quad 2^3 \quad 2^4$

Your Notes



VOCABULARY

Exponential function a function in the form of ab^x where $a \neq 0$ and b is positive and other than one.

The Graph which is means $Y = A b^x$
 Exponential growth function $y = ab^x$ where $a > 0$ and $b > 1$

$Y = AB^X$ $B = \text{Growth Factor}$

Growth factor = b

Asymptote A LINE ...that a graph approaches more and more closely

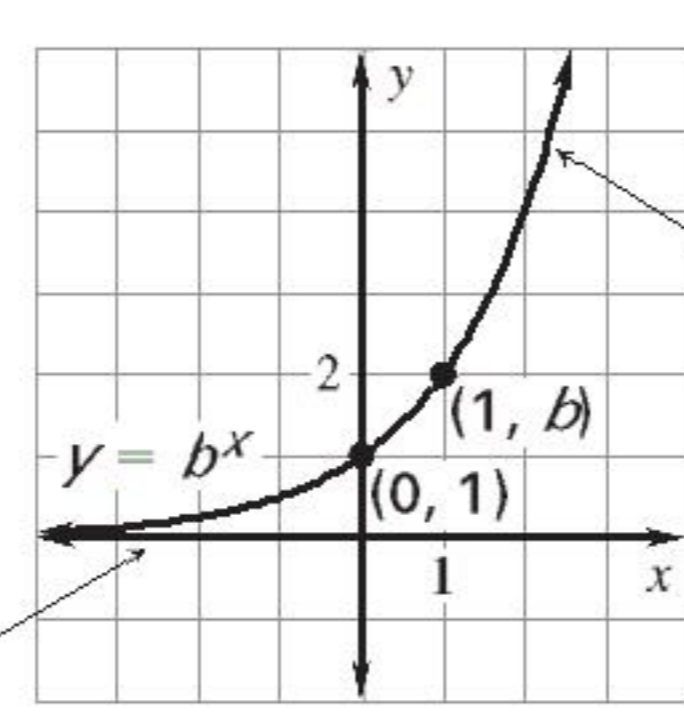
coefficient $a \neq 0$

B A S E
 > 0 positive other than 1

PARENT FUNCTION FOR EXPONENTIAL GROWTH FUNCTIONS

The function $y = b^x$, where $b > 1$, is the parent function for the family of exponential growth functions with base b . The general shape of the graph of $y = b^x$ is shown below.

The x -axis is an asymptote of the graph. An asymptote is a line that a graph approaches more and more closely.



The graph rises from left to right, passing through the points $(0, 1)$ and $(1, b)$

The domain of $y = b^x$ is $X = \{ \dots -3, -2, -1, 0, 1, 2, 3 \dots \}$
 The range is b^x real numbers

x is a set of real
 $x \in \mathbb{R}$

mathematical expression
 verbal expression?

DOMAIN

RANGE
 $\{y: 4, 5, 6, 7, 8, 9\}$

y is three more than x DOMAIN

$Y = \{1/8, 1/4, 1/2, 1, 2, 4, 8, \dots\}$ $\{ \dots 1/8, 1/4, 1/2, 1, 2, \dots \}$

$\{ \dots 125, 25, 5, 1, 2, \dots \}$ $Y > 0$ great!!

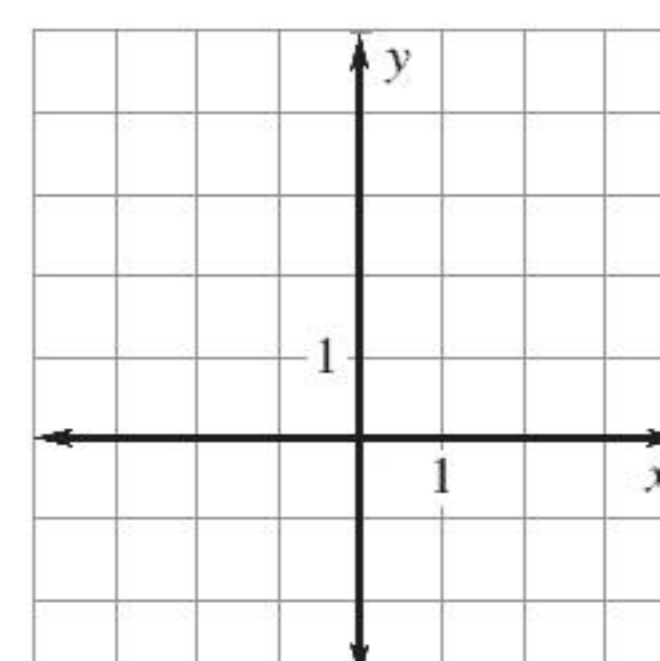
Your Notes

Example 1 Graph $y = ab^x$ for $b > 1$

Graph the function $y = \frac{1}{4} \cdot 6^x$.

Solution

Plot $(0, \underline{\hspace{1cm}})$ and $(1, \underline{\hspace{1cm}})$. Then, from left to right, draw a curve that begins just $\underline{\hspace{1cm}}$ the x-axis, passes through the two points, and moves $\underline{\hspace{1cm}}$.



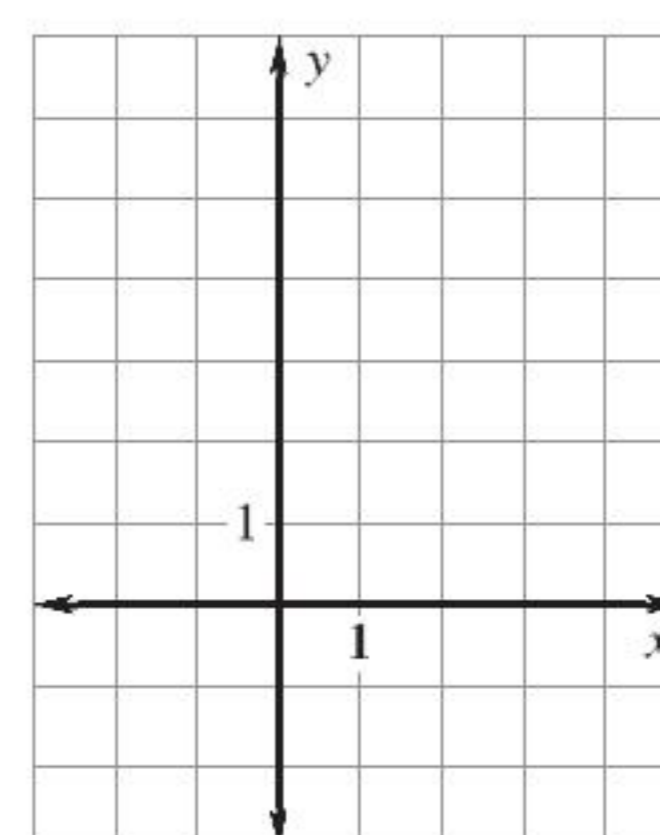
Example 2 Graph $y = ab^{x-h} + k$ for $b > 1$

Graph $y = 2 \cdot 3^{x-2} - 2$. State the domain and range.

Solution

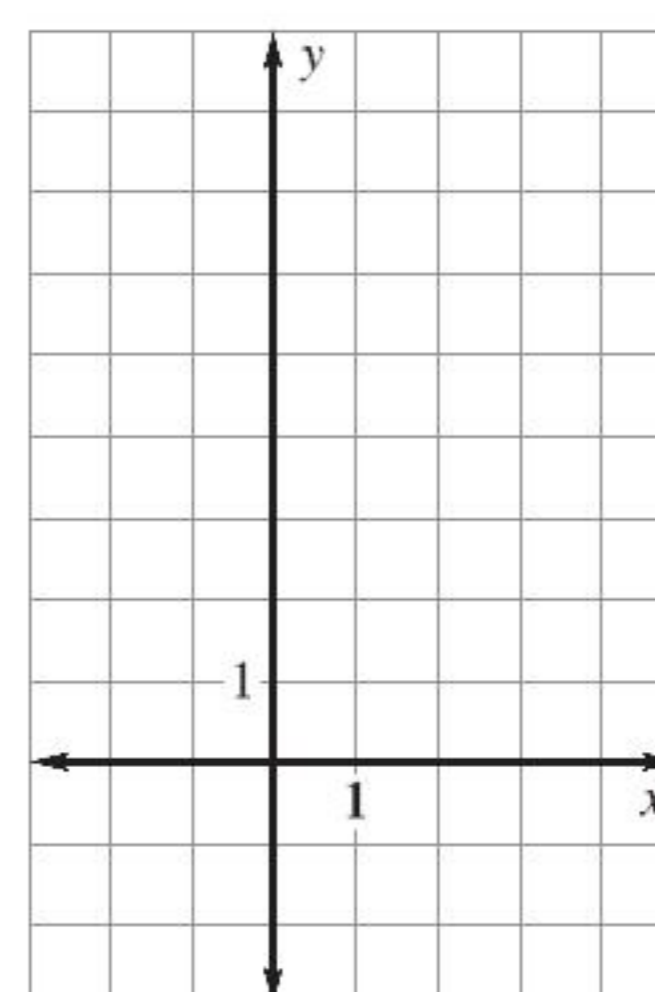
Begin by sketching the graph of $y = 2 \cdot 3^x$, which passes through $(0, \underline{\hspace{1cm}})$ and $(1, \underline{\hspace{1cm}})$. Then translate the graph $\underline{\hspace{1cm}}$ and $\underline{\hspace{1cm}}$.

The graph's asymptote is the line $\underline{\hspace{1cm}}$. The domain is all real $\underline{\hspace{1cm}}$, and the range is $\underline{\hspace{1cm}}$.



✓ **Checkpoint** Graph the function. State the domain and range.

1. $y = 2 \cdot 4^{x+1} - 3$



Your Notes

Example 3

Solve a multi-step problem

Buffalo In the last 12 years, an initial population of 38 buffalo in a state park grew by about 7% per year.

- Write an exponential growth model giving the number n of buffalo after t years. About how many buffalo were in the park after 7 years?
- Graph the model. Use the graph to estimate the year when there were about 53 buffalo.

Solution

- a. The initial amount is $a = \underline{\hspace{1cm}}$ and the percent increase is $r = \underline{\hspace{1cm}}$. So, the exponential growth model is:

$$n = a(1 + r)^t \quad \text{Write exponential growth model.}$$

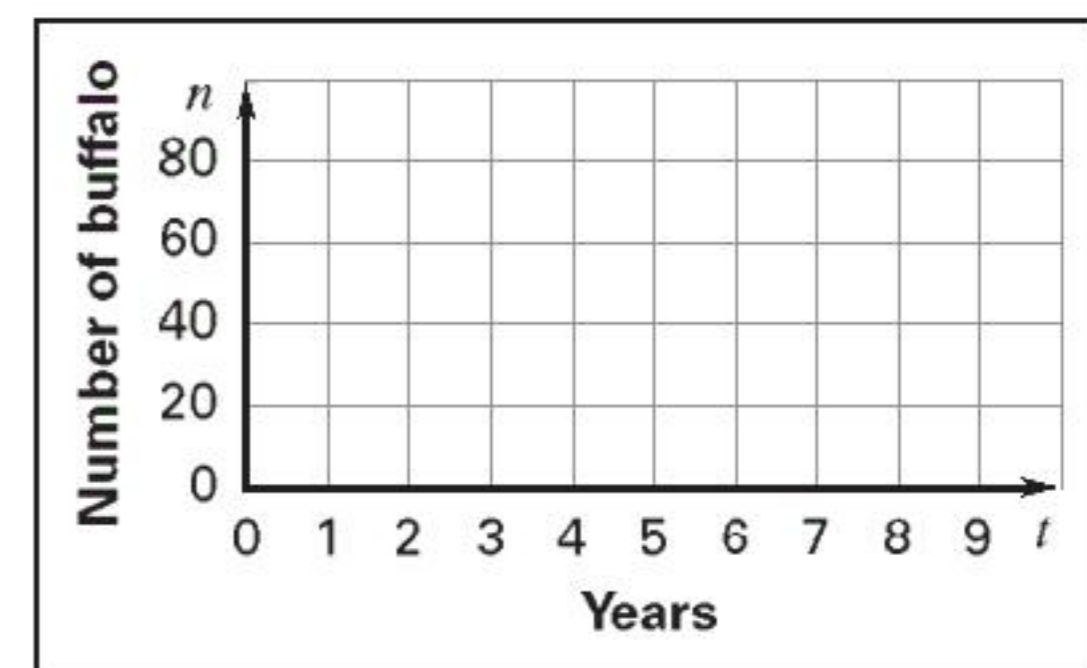
$$= \underline{\hspace{2cm}} \quad \text{Substitute for } a \text{ and } r.$$

$$= \underline{\hspace{2cm}} \quad \text{Simplify.}$$

Using this model, you can estimate the number of buffalo after 7 years ($t = 7$) to be

$$n = \underline{\hspace{2cm}} \approx \underline{\hspace{1cm}} \text{ buffalo.}$$

- b. The graph passes through the points $(0, \underline{\hspace{1cm}})$ and $(1, \underline{\hspace{1cm}})$. Plot a few other points. Then draw a smooth curve through the points. Using the graph, you can estimate that the number of buffalo was 53 after about $\underline{\hspace{1cm}}$ years.



COMPOUND INTEREST

Consider an initial principal P deposited in an account that pays interest at an annual rate r (expressed as a decimal), compounded n times per year. The amount A in the account after t years is given by this equation:

$$A = \underline{\hspace{2cm}}$$

Your Notes

Example 4 Find the balance in an account

You deposit \$2900 in an account that pays 3.5% annual interest. Find the balance after 1 year if the interest is compounded monthly and annually.

- a. With interest compounded monthly, the balance after 1 year is:

$$\begin{aligned} A &= 2900 \quad \text{Substitute for } P, r, n, \text{ and } t. \\ &= 2900 \quad \text{Simplify.} \\ &\approx \quad \text{Use a calculator.} \end{aligned}$$

The balance at the end of 1 year is _____.

- b. With interest compounded annually, the balance after 1 year is:

$$\begin{aligned} A &= 2900 \\ &= 2900 \\ &= \end{aligned}$$

The balance at the end of 1 year is _____.

✓ Checkpoint Complete the following exercises.

2. From Example 3, how many buffalo were in the park after 11 years?

3. You deposit \$5000 into an account that pays 3.72% annual interest. Find the balance after three years if the interest is compounded quarterly.

Homework